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# Financial and Institutional Determinants of Cash Holdings in the Oil and Gas Industry

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## Abstract

At the same time that a dramatic plunge in energy commodities pressured companies in the energy sector to initiate a down-cycle drill by cutting capital expenditures, selling non-core assets, and laying off personnel, the world's top producers still maintained over half a trillion dollars in liquid assets. The reasons for phenomena such as this in the global oil and gas sector are manifold. The research question for this composition is: What are the determinants, both financial and institutional, which drive oil and gas companies to hold a certain amount of cash on their balances? This paper aims to analyse these determinants in various geographical markets of the European continent over the period of 2010-2014, using models derived from both the 'tradeoff' theory and the 'pecking order' theory. The empirical results from 800 firms were acquired with panel data regression analyses. They suggest that cash holdings in the sector are negatively affected by the net working capital, leverage, collateral, and firm size, while cash flows and capital expenditures have a positive influence on cash reserves. Besides the financial determinants, we also studied the institutional determinants for the cash levels. Our findings offer evidence that firms in countries with strong governance (as measured by the World Governance Index) hold more liquidity. Furthermore, the state of financial market development (as measured by the Global Financial Centers Index) is also positively related to cash holdings with the consequence that the financial market effect dominates the influence of governance. Our empirical evaluation will be of concern to managers in the oil and gas sector, who should take into consideration the settings of their companies when making corporate cash policy choices.

**Keywords:** oil and gas companies, cash holdings, financial determinants, institutional determinants

**JEL:** G30, Q40

## Introduction

During the Global Financial Crisis of 2007–2008, Warren Buffett made an emphatic public declaration from the widely read opinion pages of *The New York Times*. He warned the public that by holding cash it “opted for a terrible long-term asset, one that pays virtually nothing and is certain to depreciate in value” [New York Times, 2008]. Interestingly enough, at the end of 2015, non-financial S&P 500 companies held \$1.44 trillion in cash on their books [MarketWatch, 2015] and ever since the financial crisis, the record high cash holdings of American firms have been attracting significant media attention [Pinkowitz et al., 2013]. In continental Europe, the energy, automobile, telecom, and utility industries were the greatest liquidity hoarders holding €490 billion [FT, 2015].

In a world of perfect capital markets, a firm does not have the need to hold any cash at all, since it can obtain funding for its profitable investment projects at negligible transaction costs [Modigliani, Miller, 1958]. Thus, cash is merely viewed as negative debt, and hence, there is no optimal cash holding level. However, many international studies demonstrate that companies maintain sizeable portions of their assets in cash. Ferreira and Vilela (2004) found an average cash ratio of 15%.

For the oil and gas sector, Antill and Arnott (2000) spotted the trend of increasing cash holdings early. They noted that the inability of the industry to reinvest all of its free cash at a required profit forced it to develop net cash on their balance sheets. Even though a dramatic plunge in energy commodities pressured companies in the sector to initiate a down-cycle drill by cutting capital expenditures, selling non-core assets, and laying off personnel, the world's top producers still had over half a trillion dollars in liquid assets at the end of 2014 [Bloomberg, 2015].

Due to the importance of liquidity and its significant role in corporate financial management, various empirical studies have been conducted to explore the factors that influence it. The U.S. studies of Opler et al. (1999) and Kim et al. (1998) lend credence to the tradeoff theory, suggesting an optimal liquidity level that results from equalizing the marginal benefits of cash holdings to their marginal costs [Von Eije, 2012]. Firms increase their cash balances with business risks, capital expenditures, and financial market access constraints, while firm size, leverage, and dividend payments reduce cash holdings. The pecking order theory [Myers and Majluf, 1984] puts forward the contentious conclusion of zero target cash levels, viewing liquidity as a cushion between retained earnings and investment necessities. To decrease their financing costs, companies fund new projects primarily with retained earnings, then with safe debt and risky debt, and lastly with equity. Having ample operational cash flows at their disposal to finance their investments, a firm repays debt and accumulates cash.

Recent studies using international samples have explored the relationship between cash holdings and countries' institutional differences, as well as the level of financial market development. The vast majority of these studies

[Dittmar et al., 2003; Ferreira and Vilela, 2004] have confirmed the tradeoff theory and presented evidence that in countries with superior investor protection and a high quality of law enforcement companies tend to carry fewer liquid assets. However, there are some contradictory results concerning the extent of the financial market development, as Ferreira and Vilela (2004) found that a higher level of financial development correlates with a negative impact on cash holdings, while Dittmar et al. (2003) observed a positive impact.

Although corporate cash holding determinants have been the subject of many studies, scholars have predominantly focused on U.S. firms, while the empirical evidence of companies from various regions in Europe is not voluminous. Additionally, it is not certain that acquired outputs can be generalized according to specific business sectors, since most previous studies are made across a number of various industries. This point highlights the importance of a sample selection. The selection from the oil and gas industry is particularly relevant, since this sector has been the world's primary commercial energy supplier for many decades and is believed that its leading role will be preserved in the years to come [EIA, 2017]. Therefore, due to the magnitude of the industry, its unique nature of extensive investments, and a notable need for external capital, we aim to provide new insights regarding the drivers of corporate cash holdings and whether this trend of money pileup in energy companies can be explained.

We reevaluated the relation between cash holdings, a country's institutional settings and the state of financial market development using a sample of 800 listed and unlisted energy firms from various geographical markets from the European continent, considered over the period of 2010–2014. The underlying research question is: What are the determinants, both financial and institutional, which drive oil and gas companies to hold a certain amount of cash on their balances? This paper contributes to the limited research on cash-holdings in the oil and gas sector. As opposed to many previous studies that support a tradeoff view, our findings confirmed that both the tradeoff and pecking order models are essential in explaining the determinants of corporate cash holdings. We show that companies from the oil and gas sector in countries with a stronger institutional framework and developed financial markets hold more liquidity when compared to firms operating in countries with weaker governance regimes. We also find that the level of capital market development is positively related with cash holdings, indicating that oil and gas companies hold more cash when they can do so.

The structure of the article proceeds as follows. Section 2 highlights the underlying financial theory and arguments as to why a company may opt to hold cash. Section 3 introduces the methodology and the data sample. Every variable deployed was given a detailed description, as well as an explanation regarding the applicability of the selected variables to our study. Section 4 presents the empirical findings. Section 5 summarizes the results and suggests directions for further empirical research.

## Theoretical framework

In the following section, we present the prevailing theories on corporate cash holdings. As there are numerous and sometimes contradictory financial ideas on the matter, we limit the scope of this review to our underlying assumptions about the topic. We begin by featuring some financial theories, then proceed to elaborate on the possible reasons for holding cash, and lastly, we present some outlines of recent research.

### Theory and empirical hypotheses

#### *Irrelevance of cash holdings*

In a world of efficient capital markets, there is no incentive to hold any liquidity as, once needed, it can be drawn from markets without hindrance and at a reasonable price [Opler et al., 1999]. Consequently, in the absence of a liquidity premium, cash holdings have no opportunity cost and do not maximize shareholder wealth. According to the classic Modigliani-Miller theory, the market value of a company has no dependence on its financing structure. In a world of perfect and frictionless capital markets, firms are always able to secure funding for their present positive net value projects so cash reserves are irrelevant. In practice, companies operate in imperfect markets and as a result, there are valid reasons for why they may opt to carry liquidity on their balance sheets and not consider external financing as a perfect substitute for internal ones.

#### *Tradeoff theory*

According to the tradeoff theory, companies establish their optimal level of liquidity by weighing the marginal costs and benefits of holding cash [Ferreira and Vilela, 2004]. The primary cost associated with cash holdings is frequently called the cost-of-carry and results from an inferior return relative to other investments of the same risk. The benefits of having ample liquidity balances arise from two motives: transaction cost concerns and precautionary intent [Dittmar et al., 2003].

Tobin (1956) found that corporate cash balances are dependent on the transaction costs that a company is exposed to while converting non-cash financial assets into cash. Due to the economies of scale, large firms carry less liquidity. Later, Mulligan (1997) confirmed that big companies tend to hold less cash as a percentage of sales compared to small companies. The transaction cost motive also considers the charges for obtaining external financing. In the presence of a liquid asset shortage, a firm will have to choose between various options: dividend and investment reduction, asset sale or borrowing funds in capital markets, with the latter being the more preferred choice [Opler et al., 1999]. The expenses attached to accessing the financial market prompt the company to resort to external financing less often and to hold an optimal amount of cash as a buffer [Kim et al., 1998]. Companies with better investment prospects are assumed to be in possession of larger liquid reserves in order to pursue the optimal investment policy and therefore the

level of capital spending should be positively related to cash balances (Dittmar et al., 2003). Bates et al. (2009) pointed to the substitution effect of working capital due to its relatively simple and quick transformation features: firms with large numbers of working capital tend to have less cash.

The precautionary motive is regarded as a preventative measure against unforeseen circumstances. The mitigation of the costs of financial distress compels firms to hold ample funds in terms of liquidity and in readily available lines of credit. Opler et al. (1999) highlight the advantage of keeping a portion of capital in the form of liquid assets, since it helps avoid passing on profitable projects due to a liquidity shortage.

#### *Pecking order theory*

Numerous market imperfections increase the costs of external financing. Donaldson (1961) observed the substantial inclination of management towards internal generation as a source of new funds. In case the need for external financing prevailed, management seldom turned to issuing equity, regarding debt as a more preferable option. As an extension, Myers (1984) and Myers and Majluf (1984) set the framework in the context of the rational expectation equilibrium. Since a seller exercises an informational advantage over a buyer, in the absence of all integral information regarding the state of the firm, the providers of capital will demand a premium for investing in or granting credit to an entity. Thus, to minimize asymmetric information and other financing costs, management will give preference to retained earnings first, then to debt, and lastly to equity.

Such a hierarchy of financial policies gained widespread recognition as the pecking order theory. Presented with sharp adverse selection costs, a company might pass on accepting value-creating projects, because it will not prove able to raise the necessary funds. As a viable response to this scenario, aiming to circumvent adverse selection costs and to not pass on positive NPV projects, a firm may choose to bulk up its financial slack (Myers, 1984). For oil companies, Chen (2016) provides evidence of a “pecking order” existing in relation to cash flows. Firms that are constrained primarily deploy their cash flows for the accrualment of cash reserves, while unconstrained firms direct their cash flows towards discharging liabilities and arranging a share repurchase program once positive cash flow shocks occur.

#### *Institutions and macroeconomic exposure*

Scholars have started focusing more on how formal and informal institutions, called “rules of the game”, are influencing the organizational and commercial behaviour of companies [North, 1991; Scott, 2014]. Drawing on original research, Acemoglu and Robinson (2012) argue that inclusive political institutions provide incentives for capital investments and economic growth. According to Bushman and Piotroski (2006), political and legal systems substantially contribute to company activity.



Bae and Goyal (2006) showed that the protection of creditor and property rights largely decreases the costs of raising funds from banks. Extending credit in economies with underdeveloped governance constitutes a significant expropriation threat, which ends up contracting the local credit distribution [Seifert and Gonenc, 2016]. Thus, strong country governance with a widely recognized rule of law and vigorously pursued creditor rights promote lower liquidity holdings within firms, while in riskier economies, companies would opt to hold more cash as a safeguard against adverse shocks [Pinkowitz et al., 2006].

## Determinants of cash holdings

### *Financial determinants*

Collateral is pledged against a loan in order to secure financing. Von Eije (2012) suggests that the manufacturing characteristics of a firm are likely to serve as collateral for debt issues. Berger and Udell (1998) point out that creditors often expect riskier borrowers to provide security for their loans. Covered loans to the oil and gas industry are deemed to be less risky compared to unsecured bonds, which could bring near-complete losses [Bloomberg, 2016]. Firms in possession of low collateral value assets are up against significant challenges in sourcing an external finance supply, forcing companies to reserve liquidity. Thus, we expect to find a negative link between cash holdings and collateralizable assets.

A company's cash holdings could be regarded as retained historical cash flows. Given the volatility of moderate cash flow, a high, current cash flow should translate to relatively high cash holdings, yielding a positive relation between the two. Additionally, according to the pecking order theory, companies will resort to internally generated funding before going to the external capital market. Therefore, large cash flows will be consistent with higher cash holdings, as confirmed by Opler et al. (1999). However, Kim et al. (1998) argue that cash flow provides an additional source of liquidity, viewing it as a cash substitute. Therefore, the relation should be negative. Consequently, the estimated relationship between cash holdings and cash flow is ambiguous.

Seifert and Gonenc (2016) found that company size holds an inverse relation to cash holdings, since larger firms are more predisposed to easier borrowing terms and effectively are spared from keeping excessive liquidity. Larger firms display fewer articulate information asymmetries and lower adverse selection costs since they are generally well developed, have established disclosure procedures, and capture more of market's attention. In addition, due to the economies of scale in obtaining external capital, smaller firms face higher financing costs prompting them to hold more liquidity [Ozkan and Ozkan, 2004]. Moreover, larger firms tend to be more diversified and thereby experience lower risk of going into financial distress, supporting the idea that smaller firms should hold more cash [Titman and Wessels, 1988]. Thus, we may assume the expected impact of firm size on cash holdings to be negative.

The fundamental advantage of corporate liquidity is its function as internal funding for value creating projects. In a pecking order environment, debt is expected to increase within a company when investment surpasses the retained earnings and to decrease when investment is less than the retained earnings. Ferreira and Vilela (2004) suggest that cash holdings should correspondingly adhere to an inverse dynamic. Cash balances are reduced when investments exceed the retained earnings and rise once investments are less than the retained earnings. In this manner, such a notion justifies the assumption of an inverse relation between cash and leverage. In much the same way, Kim et al. (1998), Opler et al. (1999) and Ozkan and Ozkan (2004) also lend credence to an inverse relation between leverage and cash holdings considering that companies can issue debt to generate cash when internal funds are small. However, this indebtedness also increases the probability of financial distress, forcing the accumulation of liquid resources. This could be viewed as a hedging tool [Acharya et al., 2007], which leads to a positive impact. Hence, the estimated relationship between cash holdings and leverage is ambiguous.

In an environment of volatile oil prices, tighter regulations and intense pressure from shareholders, oil and gas companies have been focusing meticulously on cash and working capital management by aiming to increase returns and to deliver a satisfactory cash flow to support investments and dividends [EY, 2014]. Working capital aids the industry by tapping into valuable liquidity resources and the optimization of this working capital is able to unlock the cash to support itself and invest for the future [PwC, 2015]. Opler et al. (1999) found that net working capital may serve as a substitute for cash and could be readily and relatively efficiently converted into liquidity once the need arises. Therefore, we expect to observe negative relations between the liquid asset holdings and net working capital.

Previous studies on cash holdings have shown mixed results regarding capital outlays. For instance, Mikkelsen and Partch (2002) found that high cash reserves are accompanied by greater investments, while Kalcheva and Lins (2007) observed companies with larger capital expenditure holding less liquidity. In general, the tradeoff theory predicts a positive relationship between capital expenditures and cash holdings, since firms increase their cash balances to finance capital expenditures, while the pecking order theory suggests a negative relationship as companies primarily finance their investment projects with accumulated cash [Dittmar et al., 2003]. Therefore, the relation between capital expenditures and liquidity reserves is equivocal.

### *Institutional determinants*

Strong governance ensures better property right protection by enforcing business contracts and it also improves lenders' confidence, as the probability of loan repayment and collateral repossession increases [Ayyagari et al., 2010]. Sound governance regimes contribute to lower

liquidity holdings within firms by reducing uncertainty [Seifert and Gonenc, 2016], while in riskier economies, companies tend to reserve liquidity as a precautionary measure [Pinkowitz et al., 2006]. Consequently, we expected to find a negative relationship between the quality of a country's institutional framework and the cash holdings of companies.

For the industry, access to developed financial markets is of prominent importance. Even at times when the oil price was above \$100 per barrel, major oil firms routinely needed to raise capital to cover their outlays [WS], 2015]. Besides internal actions to raise liquidity, whether through capital expenditure cuts, reductions in dividend distributions and headcount contraction, energy firms regularly turn to external sources via debt or equity offerings. According to Brogan (2015), small-cap explorers usually resort to equity issuance, whereas midcap to large-cap independent oil and gas producers are the largest users of reserve-based lending facilities from banks. Big

international oil firms heavily rely on the support from banks, infrastructure funds, pension funds, and other institutions.

Fewer developed financial markets provide a limited credit supply and higher transaction costs for obtaining additional financial resources, which ultimately results in firms hoarding more cash [Ferreira and Vilela, 2004]. Better access to finance decreases the marginal value of cash, reducing the necessity to hold a large amount of precautionary liquidity [Faulkender and Wang, 2006]. Therefore, we expected to observe an inverse relationship between cash holdings and country's capital market state. However, as noted by La Porta et al. (1997), countries with strong governance mechanisms, as indicated by the legal framework and quality of law enforcement, have better developed financial markets. Thus, we employed models that assess the impact of both factors on cash holdings and allow the comparison of their role in explaining cash reserves. See Table 1 for a summary of the above.

**Table 1.** Determinants of Cash Holdings

Variable	Relation with cash holdings	Explanation
Firm size	Negative	Economies of scale, financial constraints
Collateralizable value of assets	Negative	Ease of securing credit
Cash flow	Negative/Positive	Ready source of liquidity/ Preference for financing with internal sources
Leverage	Negative/Positive	Increased funding costs/ Avoidance of financial distress
Financial market development	Negative	Ease of access to external financing
Country governance	Negative	Uncertainty reduction
Capital Expenditures	Negative/Positive	Decrease of internal funds/ Investment support
Net working capital	Negative	Source of additional liquidity

## Hypothesis development

In view of the above, we constructed hypotheses related to corporate cash holdings that were subsequently tested and analyzed. Cash holdings in the oil and gas industry were estimated by applying the factors found to influence the cash policies of non-energy companies: collateralizable value of assets, cash flow, firm size, leverage, country governance, capital market development, and net working capital. We will use these explanatory attributes as proxies for the determinants of cash holdings.

*H1: Corporate cash holdings are inversely related to firm size*

*H2: Corporate cash holdings are inversely related to the firm's collateralizable assets*

*H3: Corporate cash holdings are inversely related to the firm's cash flow*

*H4: Corporate cash holdings are inversely related to firm leverage*

*H5: Corporate cash holdings are inversely related to the firm's net working capital*

*H6: Corporate cash holdings are positively related to the firm's capital expenditures*

*H7: Corporate cash holdings are lower in countries with strong governance*

*H8: Corporate cash holdings are lower in developed financial markets*

## Methodology and data collection

In this section, we describe the dataset that was used as well as our variables and methodology. We bring into focus the quantifiable observations that can be examined statistically and produce solid generalizations.

### Sample and Data

In order to carry out the practical part of the research, we collected secondary data from the ORBIS database, compiled by the Bureau Van Dijk. The database includes information on firms around the world, derived from their annual financial statements. In a few particular occurrences, we used primary data obtained directly from the annual reports. The sample includes listed and non-listed oil and gas companies (NACE codes 061, 0610, 06, 0620, 091, 0910, 495, 4950, 3523) from 33 European countries between the years of 2010-2014. Companies that relocated their nominal registration to other jurisdiction or subsidiaries of foreign firms were excluded. The countries that are presented vary in their institutional and economical aspects. Some were left out as companies from a sector that were lacking in some aspect.

After the corresponding criteria were applied, we proceeded to do a panel construction consisting of 800 firms representing 4,000 firms in total from yearlong observations. The sample firms meet the following criteria: (a) they possess more than \$20 million in total assets; (b) have a turnover of more than \$1 million; and (c) hold more than \$0.5 million worth of cash reserves. Predominantly, we needed variables such as the total assets, tangible assets, working capital and cash holdings to be positive, as well as any other variable defined as positive. The data covering the governance issues was acquired from the World Bank World Governance Index website and the information on the capital market from the Z/Yen Group and their Global Financial Centers Index.

As a measure of country-level governance, the World Governance Index (WGI) aggregates six key dimensions

of governance: Voice and Accountability, Political Stability, Lack of Violence, Government Effectiveness, Regulatory Quality, Rule of Law and Control of Corruption. The Global Financial Centers Index (GFCI) was obtained from a publishing agency website. This index encompasses two blocks: instrumental factors and financial center assessments.

Instrumental factors consist of five broad areas constituting the competitiveness of a capital market: Business Environment, Financial Sector Development, Infrastructure, Human Capital, Reputational and General Factors. The World Bank, The Economist Intelligence Unit, the OECD and the United Nations provided these quantitative measures. Supplementarily, we involved other firm characteristics, which we anticipated would influence cash reserves.

### Variable construction

Analogous with Ozkan and Ozkan (2004), we employed the variable CASH1, constructed as the ratio of cash and marketable securities to total assets. We also used the variable CASH2, which is identical to CASH1 except that the denominator is computed as the total assets minus the cash and cash equivalents [Opler et al., 1999]. Higher values of these variables will denote higher levels of liquidity within the company. Similarly to Titman and Wessels (1988), we used two proxies for size: SIZE1 was estimated as the natural logarithm for sales and SIZE2 as the natural logarithm for total assets. Capital market development (GFCI) was calculated by considering data from The Global Financial Centers Index. For leverage (LEV), we used the total debt to total assets. We measured capital expenditures (CAPEX) as capital expenditures to total assets. Net working capital (NWC) was estimated as the net current assets minus cash. Cash flow was considered as the pre-tax profits plus depreciation over sales (CF1) or total assets (CF2). Collateralizable assets (COLL) were a proxy for the collateral firm's need to secure the loan and were calculated as tangible assets over total assets. The measures of the country institutional framework characteristics (WGI) were governance scores obtained from the World Governance Index. For more on the definitions of the variables mentioned see Table 2 below.

**Table 2.** Description of Variables

Name	Definition
Cash holdings (CASH1)	Cash + Marketable securities/Total assets
Cash holdings (CASH2)	Cash + Marketable securities/Total assets – (Cash + Marketable securities)
Size (SIZE1)	ln (Sales)
Size (SIZE2)	ln (Assets)
Leverage (LEV)	Total debt/Shareholders equity
Cash flow (CF1)	Pre-tax profits + Depreciation/Sales
Cash flow (CF2)	Pre-tax profits + Depreciation/Total assets
Net Working Capital (NWC)	(Working capital – (Cash + Marketable securities))/Total assets
Capital expenditures (CAPEX)	Capital expenditures/Total assets
Capital market development (GFCI)	ln (GFCI)
Collateralizable assets (COLL)	Tangible assets/Total assets
Institutional Governance (WGI)	ln (WGI)

## Regression model specification

Since the data in our research encloses both time series and cross-sectional elements, the particular set of data would be known as a panel of data. We ran regressions with country-fixed effects, institutional framework characteristics, and the rating of the largest and nearest financial center respectively. Our final regressions employed both of the macro-level factors. All models were estimated using OLS regressions with the Huber-White-Sandwich robust variance-covariance estimator (VCE). The standard errors reported are robust to cross-sectional heteroscedasticity and within-panel serial correlation.

## Empirical findings

### Descriptive statistics

Table A1 in the appendix presents the descriptive statistics for cash holdings on a country by country base. Summary statistics are presented below. The average values of a cash-to-assets ratio of 12% shown in Table 3 resemble those reported by Damodaran (2005) for U.S. oil and gas companies. The same goes for the mean leverage results (48%). Additionally, the variability of governance (WGI) and financial market development ratings (GFCI) in Table 4 are, respectively, a bit smaller and somewhat more variable over time.

**Table 3.** Descriptive statistics for firm-level variables

	Mean	Standard Deviation	Percentile 25	Median	Percentile 75	Valid N
CASH1	.12	.14	.03	.07	.15	4785
CASH2	.23	1.89	.03	.07	.18	4785
SIZE1	12.37	1.81	10.94	11.95	13.37	4785
SIZE2	12.36	2.17	11.18	12.35	13.51	4572
LEV	.48	.26	.28	.49	.66	860
CF1	-5.22	175.01	.01	.07	.23	3788
CF2	-.26	22.18	.04	.08	.15	3907
CAPEX	-.099	.133	-.151	-.085	-.039	672
NWC	.00	.26	-.09	.00	.12	4785
COLL	.32	.29	.03	.25	.55	4758

**Table 4.** Descriptive statistics for country-level variables

	Mean	Standard Deviation	Percentile 25	Median	Percentile 75	Valid N
voice_accountability	79.0	23.2	75.1	91.9	93.4	4785
Polstab	63.0	22.1	57.3	63.5	76.8	4785
Goveff	79.2	19.1	67.3	89.6	92.8	4785
Regqual	80.5	19.0	74.9	86.7	94.8	4785
Rulelaw	77.1	23.7	63.0	90.1	94.2	4785
Corrupt	74.2	26.7	58.1	90.0	93.4	4785
WGI	75.5	21.5	67.2	86.4	89.3	4785
GFCI	634.4	87.8	581.0	629.0	677.0	4767



Table 5. The effects of financial factors, WGI and GFCI on cash holdings

	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10
	cash1	cash1	cash1	cash1	cash1	cash2	cash2	cash2	cash2	cash2
SIZE1	-0.00375**				-0.00512***	-0.0173***				-0.0247***
	(0.00180)				(0.00192)	(0.00622)				(0.00779)
LEV	-0.165***	-0.172***	-0.166***	-0.168***	-0.166***	-0.429***	-0.472***	-0.449***	-0.455***	-0.422***
	(0.0244)	(0.0257)	(0.0249)	(0.0306)	(0.0227)	(0.0793)	(0.0908)	(0.0858)	(0.107)	(0.0734)
CF1	-0.00000869***	-0.00000623*				0.0000212	0.0000308*			
	(0.00000321)	(0.00000363)				(0.0000154)	(0.0000177)			
NWC	-0.242***	-0.251***	-0.236***	-0.229***	-0.222***	-0.650***	-0.701***	-0.644***	-0.695***	-0.578***
	(0.0334)	(0.0345)	(0.0350)	(0.0409)	(0.0313)	(0.130)	(0.145)	(0.139)	(0.176)	(0.115)
COLL	-0.150***	-0.155***	-0.164***	-0.176***	-0.166***	-0.467***	-0.492***	-0.525***	-0.618***	-0.508***
	(0.0195)	(0.0198)	(0.0209)	(0.0252)	(0.0188)	(0.0874)	(0.0941)	(0.101)	(0.130)	(0.0820)
WGI	0.000212	0.000297	0.000264	0.000127	0.000183	-0.000976	-0.000475	-0.000553	-0.000903	-0.00105*
	(0.000207)	(0.000203)	(0.000203)	(0.000236)	(0.000207)	(0.000607)	(0.000509)	(0.000512)	(0.000635)	(0.000605)
GFCI	0.000128***	0.000116**	0.000115**	0.000145***	0.000141***	0.000697***	0.000637***	0.000627***	0.000783***	0.000706***
	(0.0000492)	(0.0000472)	(0.0000466)	(0.0000532)	(0.0000476)	(0.000208)	(0.000192)	(0.000189)	(0.000221)	(0.000188)
SIZE2		-0.00142	-0.00326**	-0.00557***			-0.00465	-0.0110**	-0.0154***	
		(0.00157)	(0.00163)	(0.00192)			(0.00400)	(0.00434)	(0.00554)	
CF2			0.0976***	0.113***	0.0851**			0.378***	0.404***	0.372**
			(0.0374)	(0.0380)	(0.0360)			(0.138)	(0.144)	(0.144)
CAPEX				0.157**					0.516**	
				(0.0609)					(0.238)	
Constant	0.211***	0.182***	0.202***	0.249***	0.225***	0.466***	0.309***	0.374***	0.463***	0.552***
	(0.0342)	(0.0351)	(0.0359)	(0.0419)	(0.0356)	(0.0958)	(0.0849)	(0.0871)	(0.110)	(0.110)
N	758	758	758	591	807	758	758	758	591	807
R²	0.261	0.258	0.267	0.317	0.281	0.158	0.154	0.162	0.195	0.167
adj. R²	0.254	0.251	0.260	0.308	0.275	0.150	0.146	0.154	0.184	0.160
AIC	-1184.3	-1181.7	-1190.5	-883.2	-1149.8	1013.3	1016.8	1009.6	903.3	1213.0
BIC	-1147.3	-1144.7	-1153.5	-843.8	-1112.3	1050.3	1053.8	1046.7	942.7	1250.5

## Regression models

The standard errors in our first set of models are not seriously inflated by the collinearity among regressors. Adding CAPEX improves the models, but CAPEX is missing for some of the companies, which decreases the sample size. Country fixed effects were included into all the models, but are statistically significant ( $p < 0.05$ ) only for the models explaining CASH1, and not for the models of CASH2. We found that some unobserved country-specific characteristics are able to influence CASH1, which points to the possibility of including institutional framework measures. We do so with the World Governance Indicators (WGI) as possible determinants. These indicators are highly correlated with one another. Consequently, similarly to Seifert and Gonenc (2015), we averaged them out across all six items. Controlling for firm characteristics, the WGI is significantly positively associated with cash holdings ( $p < 0.01$ ). We cannot rule out the possibility of the presence of other country-specific factors such as certain laws and regulations that are difficult to account for in modeling. Indeed, we found that financial development does also matter.

Our further discussion will be based on the models that accounted for firm characteristics, governance characteristics and financial market development as presented in Table 5 below. It could be argued that the financial market ratings vary by year and thus, there may be some sort of variable bias that was omitted and was caused by not accounting for time effects. However, the parameter estimates for the last set of regressions with time-fixed effects and which were not shown demonstrate the robustness of our findings.

## Regression results

### *Financial determinants*

In line with Hypothesis 1, firm size (SIZE1 and SIZE2), denoted either as total sales or as total assets, has a negative coefficient with a varying significance, which is consistent with the idea that larger firms can access capital markets more easily and thus do not need to hold much cash. The negative relationship lends credence to the tradeoff argument, previously supported by Opler et al. (1999), Kim et al. (1998) as well as Seifert and Gonenc (2016). Smaller oil and gas companies with less operational flexibility have limited access to liquidity via public or private capital markets, while bigger energy companies are provided relatively easy access to cheap debt financing [Powell, 2015]. J.P. Morgan's (2015) research also attests that the size and scale of oil and gas companies are the key determinants of their credit quality. A larger size helps companies to move into higher rating categories and leads to better credit access.

The significant negative relationship between collateralizable assets and cash holdings confirms the evidence from a European study by Martínez-Carrascal (2010) confirming Hypothesis 2. Since the proportion of tangible assets in a firm's balance sheets is a variable linked to their access

to external finance, this negative relationship results in easier access to external financing when a company applies for a loan, which is largely in line with tradeoff arguments. For the oil and gas sector, reserve interests and operational cost intensive equipment help to establish the loan amount and steer the availability of funds. Therefore, oil and gas companies that have a strong balance sheet to incur debt at cost-efficient rates can effectively manage their capital agenda [Bloomberg, 2016].

Hypothesis 3 was rejected. We found a significant relationship opposite to what we hypothesized. Similarly to Ferreira and Vilela (2004), the sign of cash flow to the asset (CF2) coefficient was positive, which contradicts the tradeoff argument, but supports the pecking order theory. In line with Saddour's research on French firms (2006), cash balances increase along with cash flow levels, since companies can use their cash flow as a liquidity substitution for finance investments. Therefore, as with other companies, oil and gas firms primarily fund themselves internally with cash flow and externally with debt [J.P. Morgan, 2015]. Findings by Chen (2016) also suggest that oil companies build up cash reserves from cash flows. As noted by Gavrilenkov et al. (2013), oil companies have great influence over their cash management policy design and can fine-tune conditions to given circumstances to have a ready source of liquidity.

Our findings confirmed Hypothesis 4. Pursuant to Kim et al. (1998), Opler et al. (1999), Ozkan and Ozkan (2004) and Seifert and Gonenc (2016), leverage (LEV) significantly negatively impacts cash holdings, suggesting that highly leveraged companies resort to lower cash balances. The pecking order theory stipulates a negative relation between cash holdings and leverage: when investment needs outstrip their internal funds, firms issue new debt. In such a manner, once cash holdings fall, the leverage increases. Developments in oil and gas capital spending and production confirm this. Firms substantially increased their investment outlays in order to finance the expansion of production capacity and to facilitate new project development [EIA, 2016] that could not be financed entirely through internal funds.

In the results, the negative attribute of the NWC coefficients is similar to those documented in Opler et al. (1999) and Bates et al. (2009), which supports Hypothesis 5. It is consistent with the tradeoff model that regards working capital as a substitute for cash holdings, since such readily obtainable assets other than cash can be liquidated in the event of a liquidity shortage. Indeed, as reported by EY (2014), companies from the oil and gas sector have been progressively focusing their attention on cash and working capital management, in an attempt to increase the returns on capital and to deliver sufficient cash flow to support investments. There is a rising awareness of how much value is left out because of the previous small focus on working capital management and the firms have to operate in a lower surplus cash environment. Contrary to the observations of Kalcheva and Lins (2007), who found cash to be negatively related to capital ex-

penditures, the relationship was positive and significant in our sample, which is in line with Hypothesis 6. This suggests that oil and gas companies increase their cash levels in order to finance capital expenditures. Largely consistent with Mikkelsen and Partch (2002), the cash balances of energy companies should be sufficient to cover investment programs. This positive relation is consistent with firms who are building up a substantial buffer of immediately available liquidity for precautionary reasons.

### ***Institutional determinants***

We reported evidence that companies from the oil and gas sector in countries with a stronger institutional framework (WGI) hold more cash compared to firms operating in countries with weaker governance regimes. Therefore, we rejected Hypothesis 7, as the findings contradict our initial expectations and the empirical evidence of Dittmar et al. (2003) and Seifert and Gonenc (2016). The results are in line with Caprio et al. (2013), who also found a positive relation between government quality and corporate cash holdings. In a global sample, they found that quality governance governments tend to hold back from expropriation actions, and thus companies can hold more liquidity with less fear of government seizure. Conversely, consistent with the precautionary motive, companies tend to shelter cash holdings from expropriation by carrying lower cash balances and channeling liquidity into less exposed tangible assets. Iskandar-Datta and Jia (2014) also arrived at largely resembling findings.

Hypothesis 8 was also rejected, as we found the level of capital market development (GFCI) was positively related with cash holdings, which is contrary to Ferreira and Vilela (2004), but consistent with Dittmar et al. (2003). Oil and gas companies hold more cash in developed capital markets and liquidity balances do not seem to be determined by the failure to draw external financing. This behavior could be explained by precautionary reasons (Opler et al., 1999). Firms hold excess cash to ensure that they will retain the ability to invest when cash flow is too low, compared to investment requirements. The results also suggest that the financial market effect dominates the governance effect, meaning that cash holdings in this sector are clearly more sensitive to financial market development levels than to governance factors.

## **Conclusions**

We explored the determinants of cash holdings for oil and gas firms in Europe, using panel data for the period of 2010-2014. We modeled the cash-to-asset ratio as a function of the company and country features. Similar to previous observations [Opler et al., 1999; Ozkan and Ozkan, 2004; Bates et al., 2009], our findings suggest that the cash balances held by oil and gas firms are negatively affected by firm size, the amount of liquid asset substitutes, as well as leverage and they also have positive relations with firm capital expenditures. These findings are largely in line with the tradeoff reasoning that the optimal level of cash

holdings is the result of firms stacking up the marginal costs against the benefits of carrying liquid balances.

This is primarily applicable in the oil and gas sector, where intrinsic forecasting challenges make holding a substantial buffer of immediately available funds of paramount importance. Consistent with Ferreira and Vilela (2004), and Saddour (2006), we found a positive relation between cash flow and cash holdings, which supports the pecking order theory. So we can assume that both the tradeoff and pecking order theories provide a valid interpretation of the determinants for cash holdings in oil and gas companies.

We provided evidence that firms in countries with strong governance hold more cash. This is in line with the findings of Caprio et al. (2013), who suggest that in countries with poor governance, firms shelter assets from state expropriation by keeping less liquidity, which is more vulnerable to expropriation than illiquid tangible assets (Myers and Rajan, 1998). The level of financial market development is positively related to cash reserves, with the financial market effect dominating the governance effect, which is likely to be indicative of the industry's immense appetite for capital.

With this contribution, we showed that managers should take into consideration the settings of their companies when making corporate cash policy choices. We look forward to promoting further research on cash holdings in oil and gas companies. It could be viable in future works examining whether the cash ratios of listed oil and gas companies significantly vary in comparison to those of their unlisted peers, as earlier evidenced by Von Eije (2012) for an international sample of manufacturing firms. Also, we have not explored whether the performance of oil and gas companies with large cash holdings differs from that of firms with lower liquidity balances. Therefore, analyzing the consequences of the high cash reserves of energy companies in an international setting is certainly a notable area for future research.

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## APPENDIX

Table A1. Summary statistics by country: cash holdings

	cash1					cash2				
	Mean	SD	Perc. 25	Median	Perc. 75	Mean	SD	Perc. 25	Median	Perc. 75
AT (Austria)	0.149	0.129	0.052	0.11	0.206	0.21	0.23	0.055	0.124	0.259
BA (Bosnia-Herzegovina)	0.059	0.026	0.034	0.058	0.08	0.063	0.03	0.035	0.062	0.087
BE (Belgium)	0.13	0.106	0.049	0.089	0.184	0.17	0.176	0.051	0.098	0.225
BG (Bulgaria)	0.102	0.076	0.029	0.102	0.144	0.122	0.101	0.03	0.114	0.169
CH (Switzerland)	0.191	0.136	0.092	0.173	0.285	0.273	0.233	0.102	0.21	0.399
CY (Cyprus)	0.068	0.048	0.037	0.062	0.078	0.076	0.059	0.039	0.067	0.084
CZ (Czech Republic)	0.079	0.086	0.023	0.057	0.086	0.099	0.137	0.024	0.061	0.094
DE (Germany)	0.15	0.157	0.045	0.096	0.205	0.257	0.485	0.047	0.106	0.258
DK (Denmark)	0.146	0.047	0.111	0.144	0.149	0.174	0.067	0.124	0.169	0.175
EE (Estonia)	0.062	0.079	0.024	0.038	0.066	0.076	0.129	0.025	0.04	0.071
ES (Spain)	0.09	0.108	0.029	0.056	0.102	0.123	0.214	0.029	0.059	0.113
FI (Finland)	0.021	0.022	0.006	0.009	0.04	0.022	0.024	0.006	0.009	0.042
FR (France)	0.13	0.14	0.034	0.081	0.183	0.203	0.365	0.035	0.088	0.224
GB (Great Britain)	0.151	0.177	0.033	0.082	0.197	0.316	0.804	0.034	0.089	0.245
GR (Greece)	0.096	0.084	0.046	0.077	0.104	0.118	0.131	0.049	0.083	0.116
HR (Croatia)	0.048	0.045	0.015	0.029	0.073	0.053	0.054	0.015	0.03	0.079
HU (Hungary)	0.084	0.094	0.017	0.054	0.115	0.106	0.146	0.018	0.057	0.131
IE (Ireland)	0.172	0.24	0.025	0.072	0.225	0.989	3.105	0.026	0.077	0.29
IT (Italy)	0.087	0.115	0.023	0.048	0.098	0.321	4.883	0.024	0.05	0.109
LI (Liechtenstein)	0.236	0.067	0.221	0.267	0.277	0.316	0.107	0.284	0.363	0.382
LT (Lithuania)	0.073	0.05	0.038	0.057	0.1	0.082	0.063	0.039	0.06	0.111
LU (Luxembourg)	0.167	0.182	0.034	0.083	0.274	0.278	0.377	0.035	0.09	0.412
LV (Latvia)	0.112	0.081	0.052	0.088	0.127	0.136	0.119	0.055	0.096	0.146
MT (Malta)	0.02	0.005	0.017	0.018	0.022	0.02	0.005	0.017	0.018	0.022
NL (Netherlands)	0.151	0.156	0.031	0.089	0.234	0.235	0.325	0.032	0.098	0.306
NO (Norway)	0.117	0.147	0.019	0.06	0.155	0.21	0.567	0.019	0.064	0.184
PL (Poland)	0.108	0.101	0.037	0.06	0.162	0.138	0.158	0.039	0.064	0.193
PT (Portugal)	0.044	0.04	0.014	0.027	0.083	0.048	0.046	0.014	0.028	0.091
RO (Romania)	0.056	0.077	0.016	0.029	0.059	0.069	0.128	0.017	0.03	0.063
RS (Serbia)	0.033	0.04	0.003	0.015	0.061	0.036	0.045	0.003	0.015	0.065
RU (Russia)	0.079	0.095	0.017	0.042	0.108	0.103	0.172	0.017	0.044	0.121
SE (Sweden)	0.064	0.044	0.027	0.062	0.091	0.071	0.053	0.028	0.066	0.101
SI (Slovenia)	0.035	0.023	0.012	0.041	0.054	0.037	0.025	0.012	0.043	0.057
SK (Slovak Republic)	0.095	0.074	0.042	0.058	0.13	0.112	0.101	0.044	0.062	0.15
TR (Turkey)	0.151	0.173	0.02	0.077	0.229	0.267	0.498	0.02	0.084	0.297
UA (Ukraine)	0.08	0.087	0.015	0.053	0.124	0.099	0.131	0.015	0.055	0.141